A satellite with solar panels is shown in space against a background of stars and a nebula. The satellite is the central focus, with its solar panels extended. The background is a deep blue and purple space scene with numerous bright stars and a soft, glowing nebula.

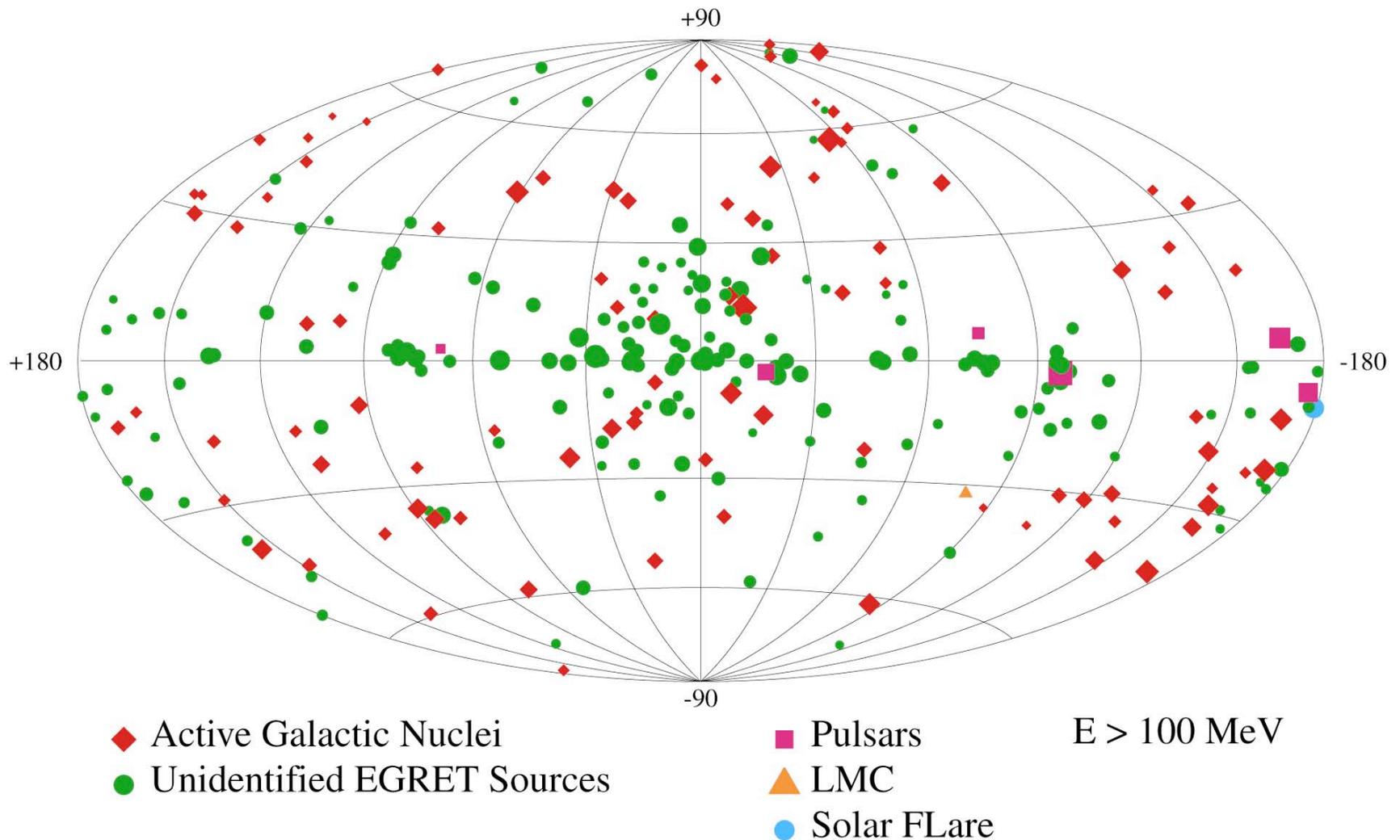
A comprehensive approach to γ -source identification

*Patrizia Caraveo & Olaf Reimer
on behalf of the LAT UNID Team*

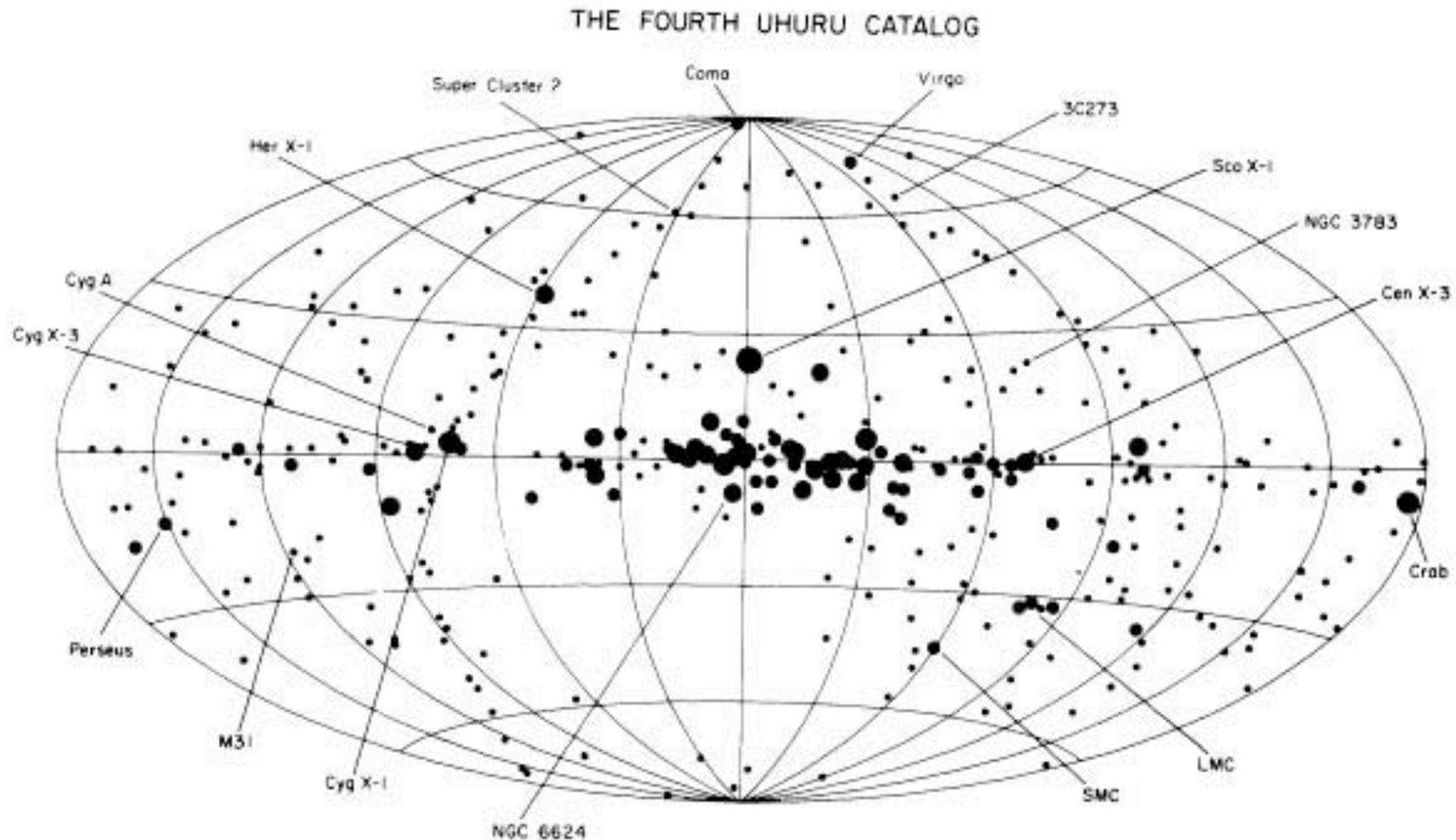
The state of the art in γ -ray astronomy

•271 sources

172 UGO



Is it an anomalous situation ?



339 sources

206 without ID

**The presence of unidentified sources is normal,
when a field is (still) in its infancy**

Genuinely **new**
class of objects

Known objects with a
new phenomenology

**Known
(catalogued)
objects, floating
in big error boxes**

Improving angular resolution is always beneficial

In the X-ray domain, focussing techniques dramatically improved angular resolution

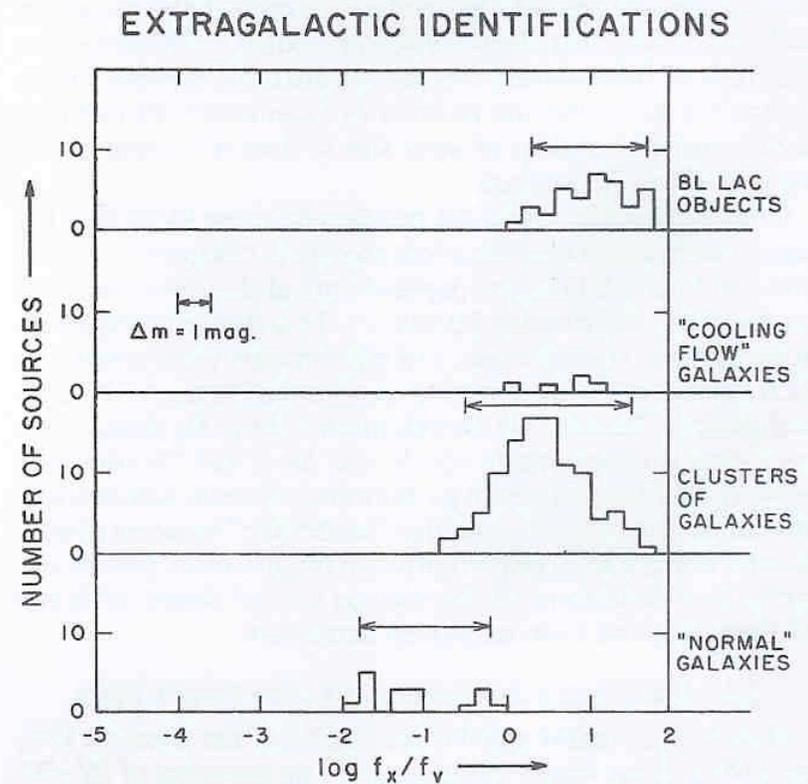
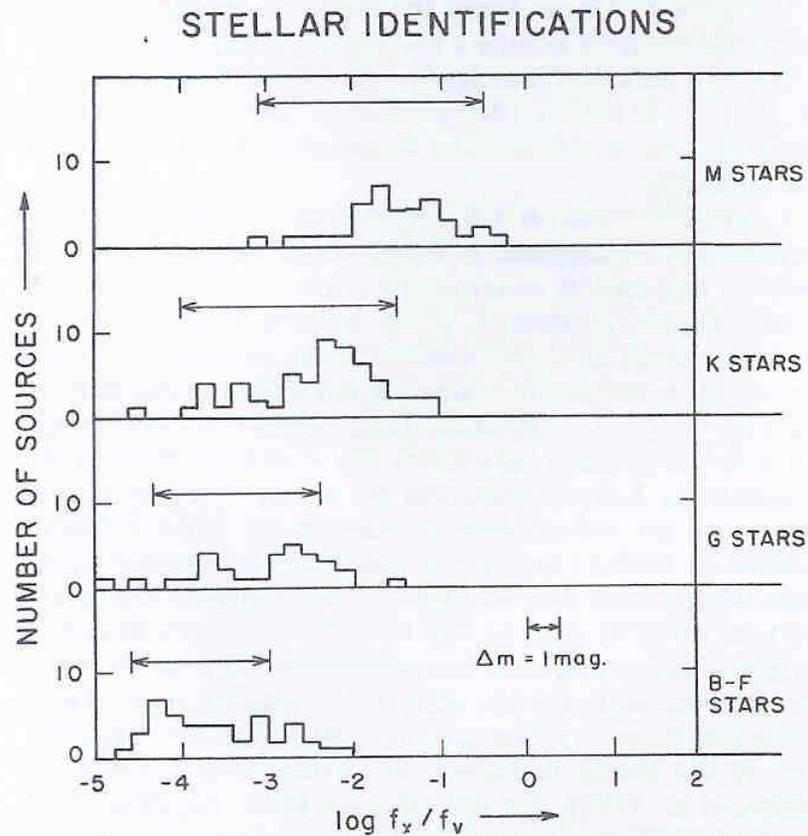
Einstein, ...Rosat,... Chandra and XMM-Newton
1978 1999- today

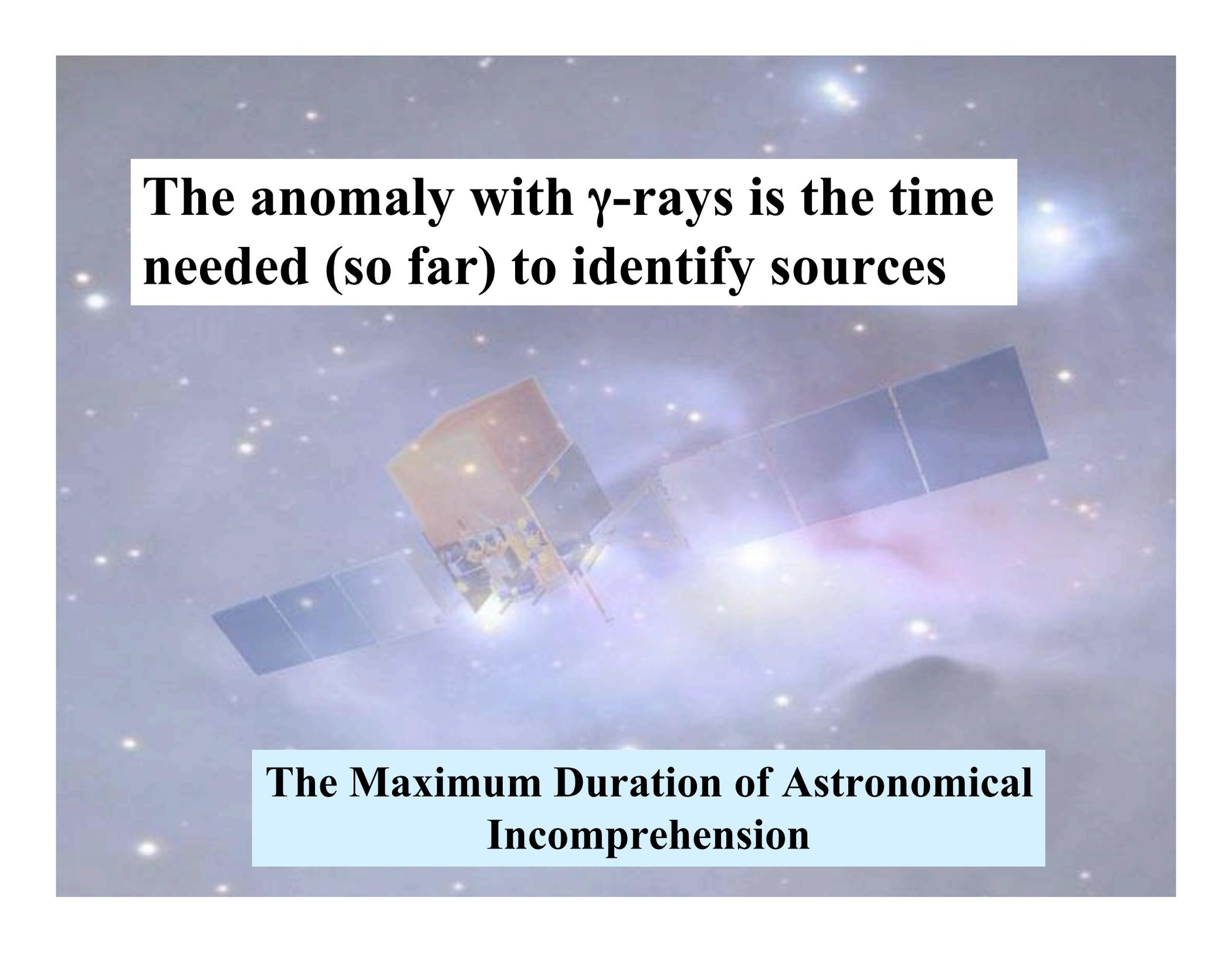


Unidentified X-ray sources are a rare exception

Plentiful individual identifications yielded statistical tools such as the F_x/F_{opt} parameter.

1991ApJS...76..813S



A satellite with solar panels is shown in space against a background of stars and a nebula. The satellite is positioned in the center-left of the frame, with its solar panels extending outwards. The background is a deep blue and purple space with numerous bright stars and a faint nebula. The text is overlaid on a white rectangular box in the upper left and a light blue rectangular box in the lower right.

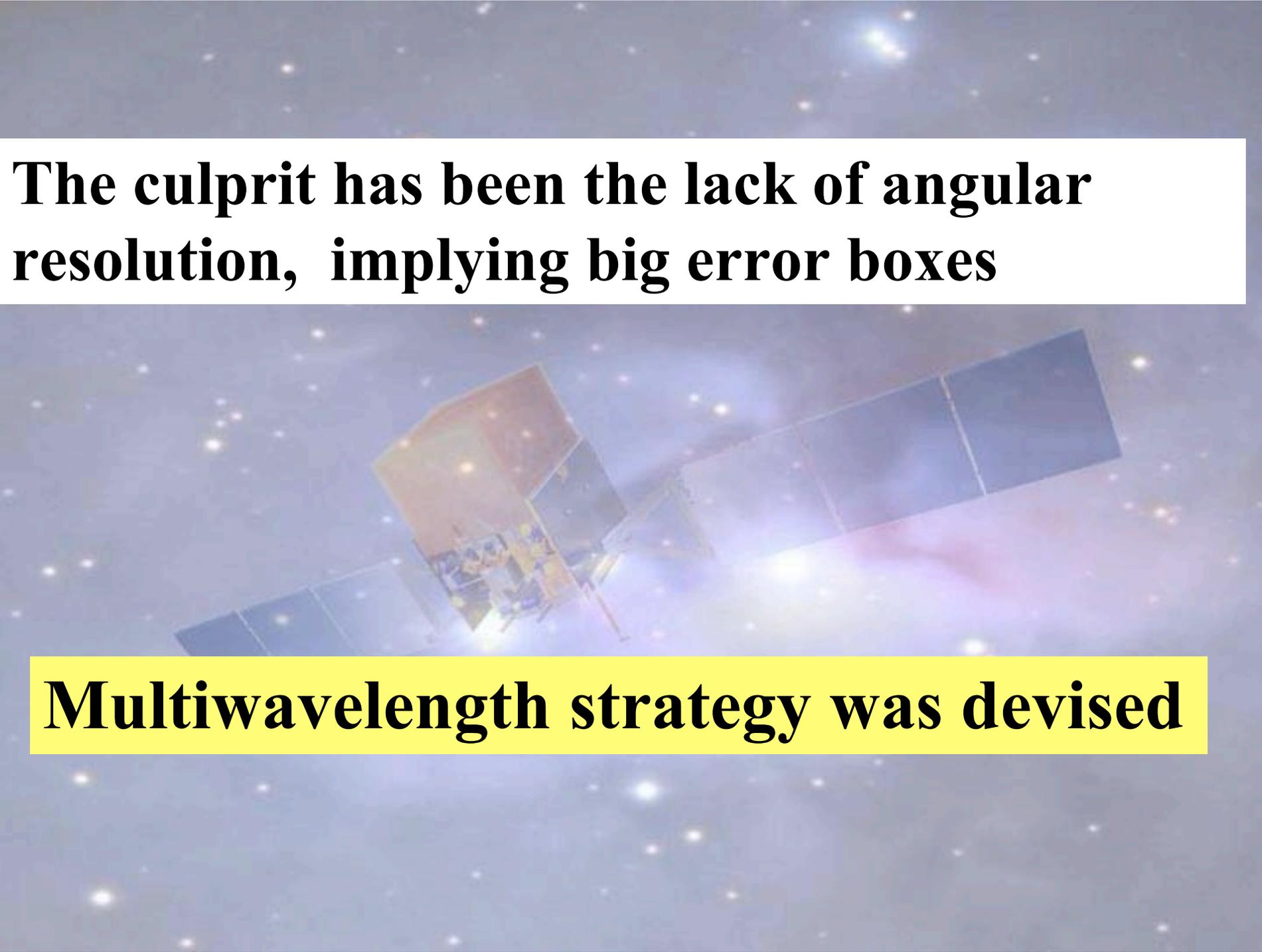
The anomaly with γ -rays is the time needed (so far) to identify sources

The Maximum Duration of Astronomical Incomprehension

V. Trimble , 2003

- To those of us who lived through the period, the 24 years between the discovery of gamma ray bursts (1973) and their identification with very powerful events at cosmological distances (1997) seemed very long. The case will, however, be made that Mira variables, coronal lines, and others remained puzzling much longer, from the time when they were recognized as requiring an explanation until a successful explanation was found. It is possible that some phenomena now with us (the nature of dark matter, cosmic ray acceleration, etc.) will also exceed the GRB mark and perhaps even the coronal line century.

1CG catalogue has been published in 1977

A satellite with solar panels is shown in space against a starry background. The satellite is positioned in the center-left of the frame, with its solar panels extending towards the right. The background is a deep blue space filled with numerous bright stars of varying sizes and colors, including white, yellow, and blue. The overall scene is a clear representation of a satellite in orbit.

The culprit has been the lack of angular resolution, implying big error boxes

Multiwavelength strategy was devised

GEMINGA (2CG 195+04)

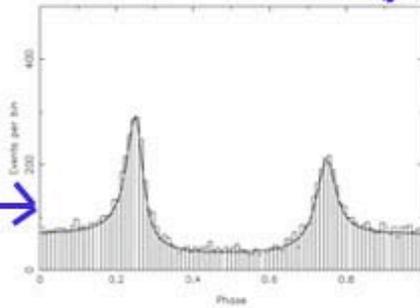
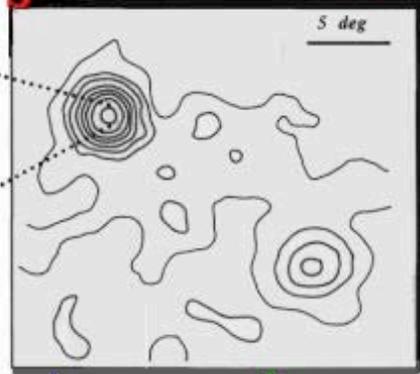
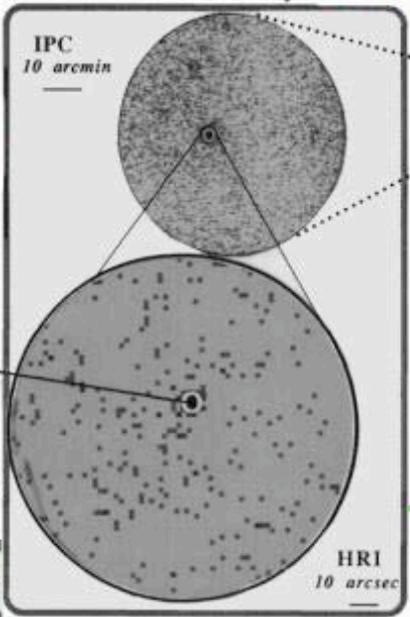
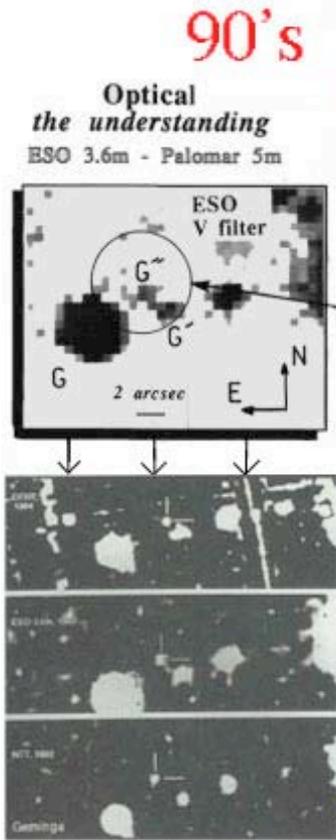
X-ray
the positioning
Einstein Observatory 80's

Gamma-Ray
the discovery
SAS-2 and COS-B 70's

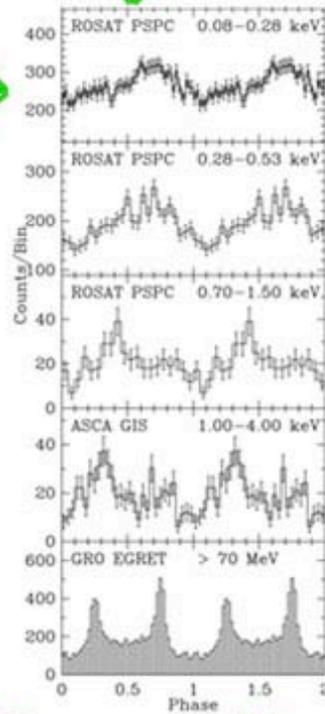
Geminga is
a success
story based
on

- luck

- endurance

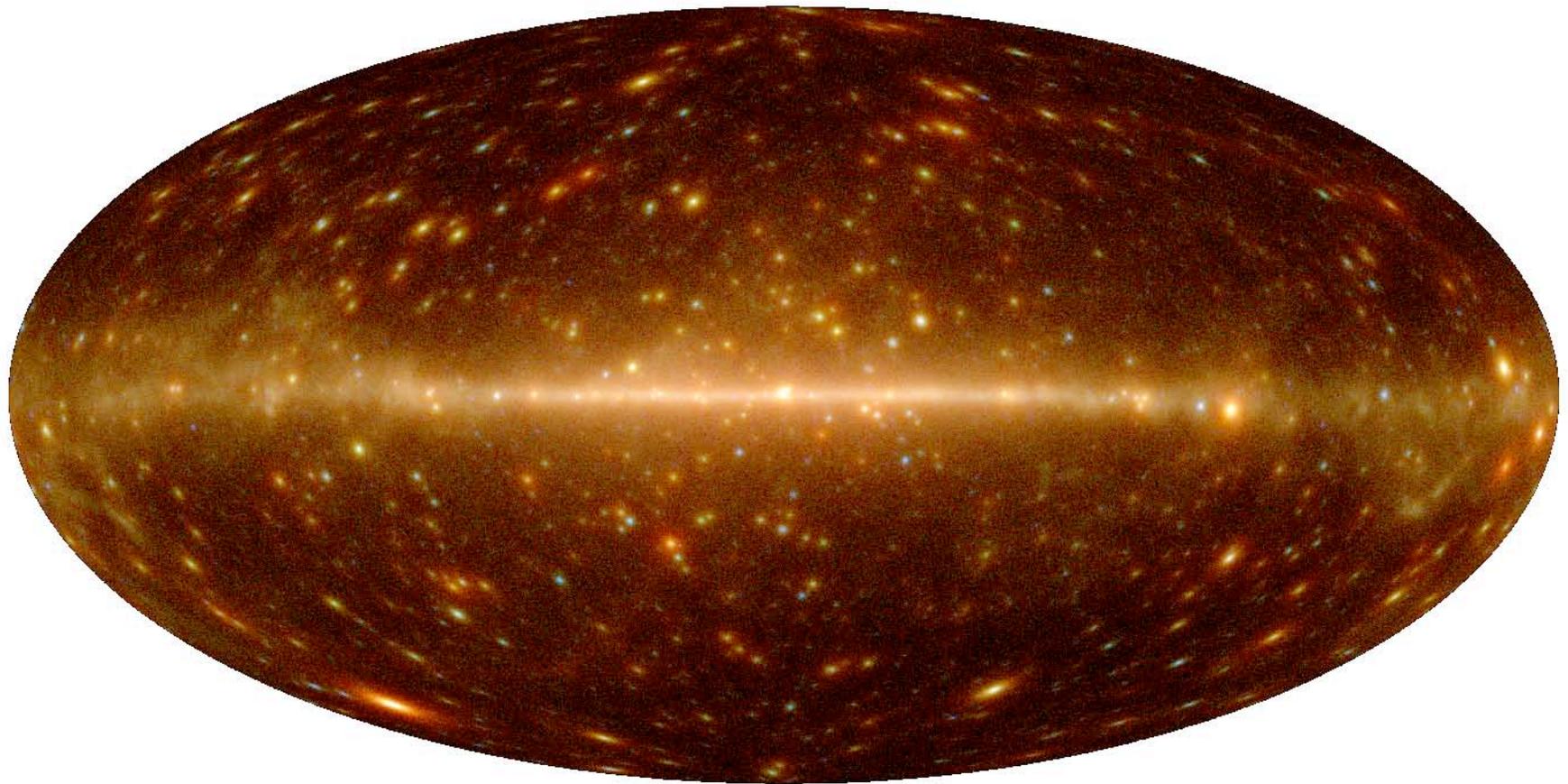


Egret phasogram, '98
the optical- γ connection



237 msec periodicity, '92
the x- γ connection

Proper motion
discovery '92

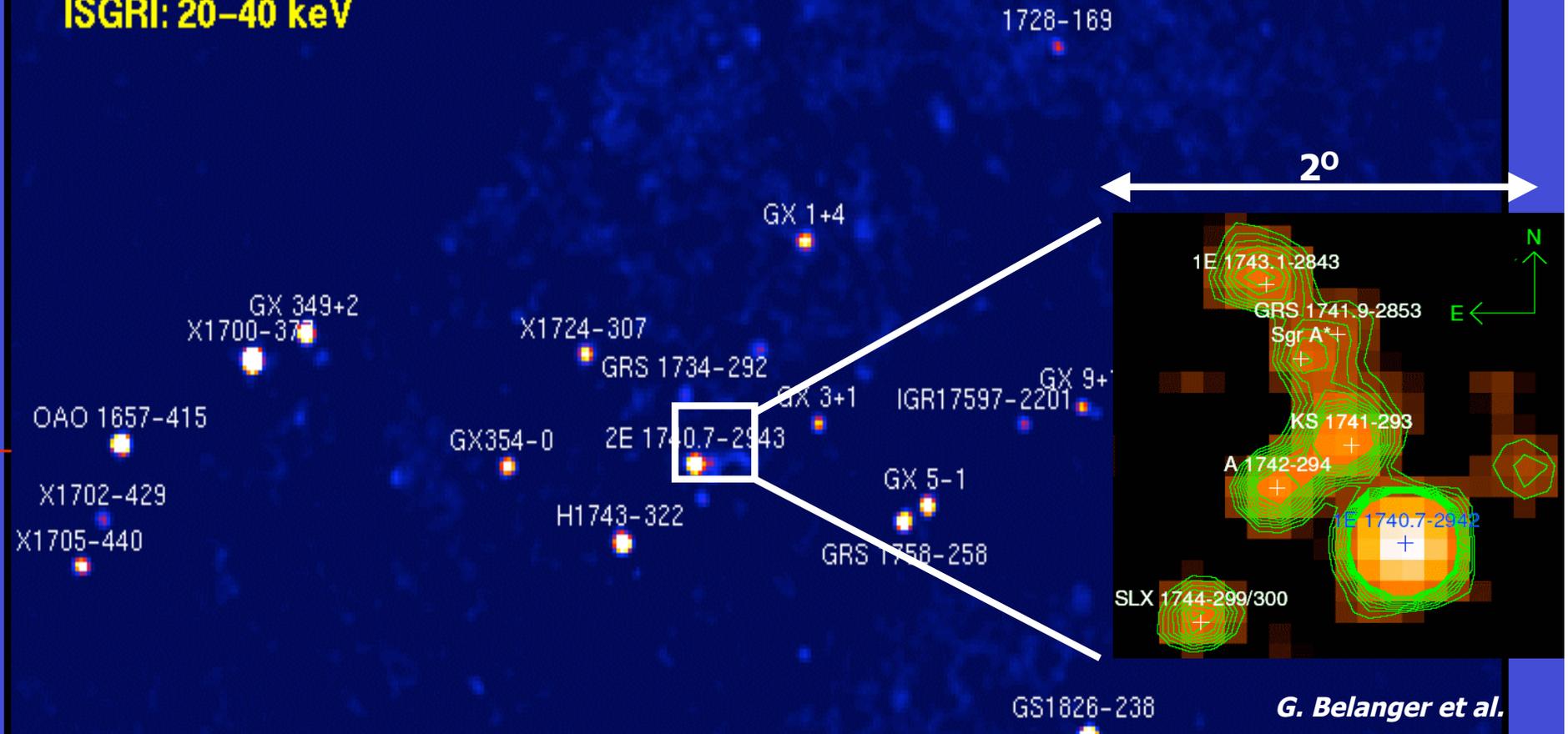


GlueX will detect hundreds of sources which will be positioned at a 5-10 arcmin level

10

INTEGRAL Map of the Central Galactic Region

ISGRI: 20–40 keV



G. Belanger et al.

Not enough for a straightforward identification

Multiwavelength zooming is still needed

-10

a standard multi λ approach **cannot be applied** to hundreds of sources

Observing time (impossibly) intensive

Often not conclusive

Shallow XMM observations (10 ksec)
yield 150 sources /sq deg., i.e.:

- Error radius 10' \rightarrow 15 sources
- Error radius 5' \rightarrow 4 sources
- Error radius 3' \rightarrow 1-2 sources

Optical/radio
follow-up
difficult

Will population studies help?

Yes, to indicate which source populations may hide in the diversity of LAT detections.

EGRET: SNRs!, OB-associations, WRs?, ... ?

No, we still have to single out archetypal individuals of new source classes and firmly identify them in $\lambda\lambda\lambda$.

There's no way around having a viable $Mult\lambda\lambda\lambda$ identification scheme for LAT source identifications!

We propose a 2-step approach

1 -From detection to association

**2 -From association to
identification**

1 -From detection to association

Figure of merit approach

Smart use of catalogues

FoM from:

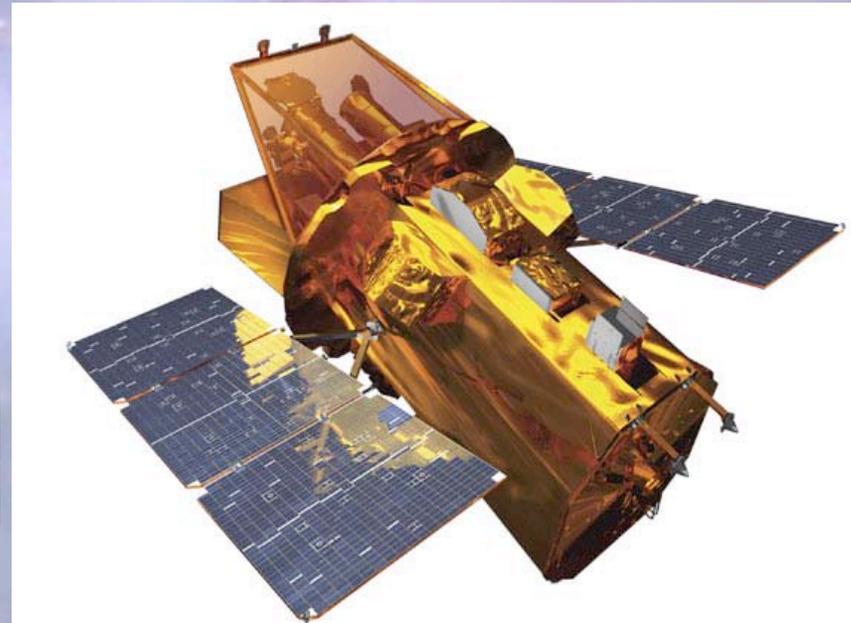
- educated guesses on c.o.p.
- variability,
- energetics

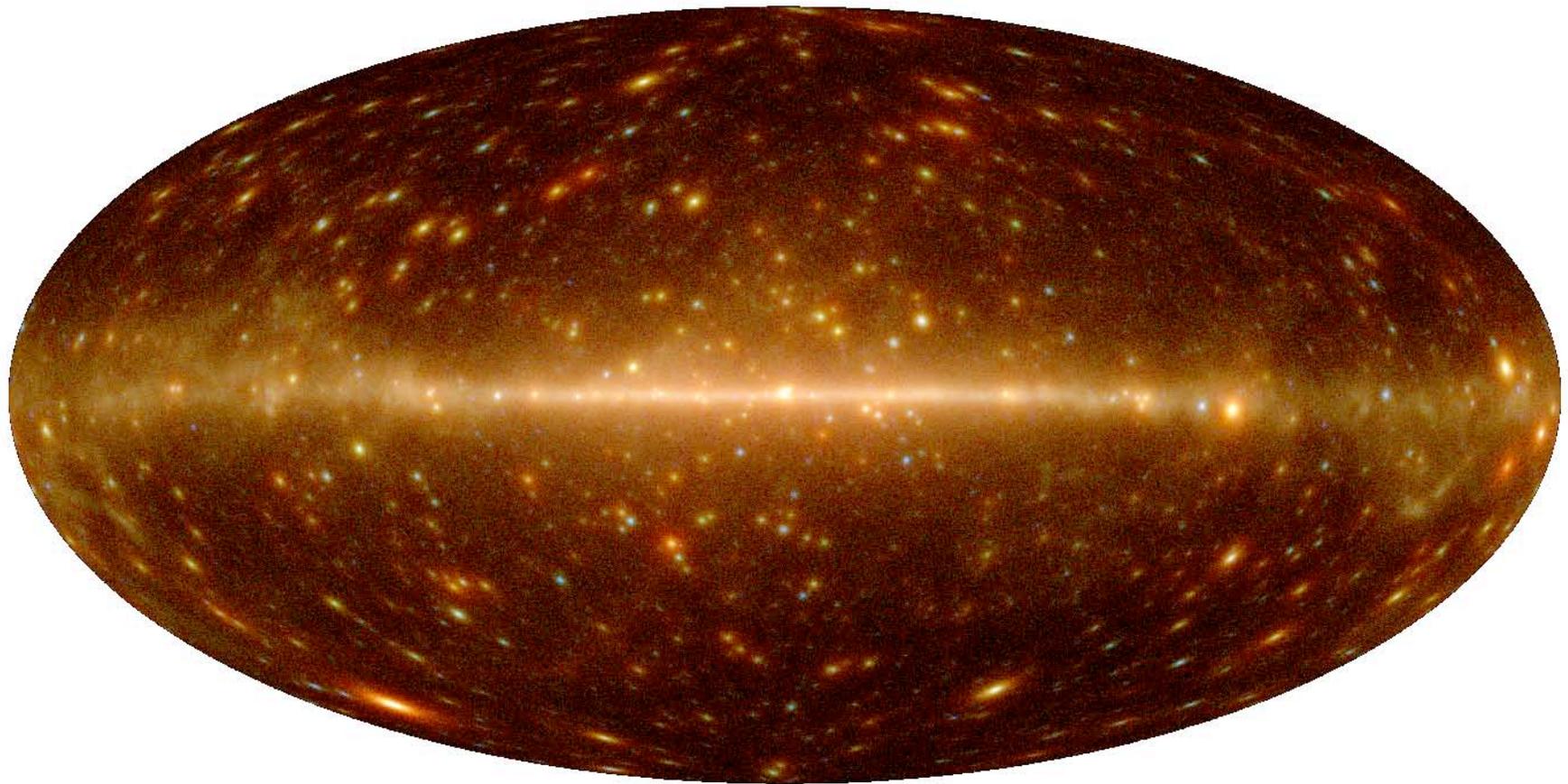
FoM suggests plausible associations

2 -From association to identification

**Multi $\lambda\lambda$ ob's of high FoM targets can
secure identifications**

e.g.:Swift filler obs time





Individual identifications will provide statistical tools, such as F_{γ}/F_x or $F_{\gamma}/F_{\text{radio}}$ or $F_{\gamma}/F_{\text{opt}}$...